

THE TAXONOMIC CHARACTERS OF THE LARVAE
OF THE GENUS CULISETA FELT, 1904 IN CALIFORNIA¹

(Diptera, Culicidae)

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In order to facilitate the tremendous amount of identification required for operational field projects, a study was undertaken to discover characters in the fourth stage larvae of the four Californian species of *Culiseta* which could be used for identifying unmounted material with the aid of a dissecting microscope (x 72). The use of the taxonomic characters employed by previous workers are only in part suitable for this purpose.

The four species involved in this study are: *Culiseta (Culiseta) impatiens* (Walker, 1848), considered to be rare in the State, adults having been reported from Butte, El Dorado, Mariposa, Sacramento, and Shasta Counties; *C. (C.) inornata* (Williston, 1893), reported from 44 of the 58 counties in California; *C. (C.) incidens* (Thomson, 1868), the most widely distributed in the State, having been reported from 53 counties; and *C. (C.) maccrackena* Dyar & Knab, 1906, with a distribution of 28 counties.

To separate *impatiens* from the other three species of *Culiseta* found in California, the character of similar upper and lower head hairs (see Plate 1, Fig. A) as listed by earlier authors (Freeborn, 1926; Dyar, 1928; Reeves, 1941; Freeborn and Brookman, 1943; Matheson, 1944; and Usinger, La Rivers, Chandler, and Wirth, 1948) appears to be adequate.

In the separation of *inornata* from *incidens*, previous workers have used characters to be found on the basal pecten teeth; in *incidens* these teeth have 1—3 minute or depressed denticles, while in *inornata*, 3—4 outstanding denticles are present. This character has proved to be reliable (see Plates 2 and 3), but somewhat impractical for rapid identification in that it necessitates the time-consuming task of mounting individual specimens. Differences in the size of the comb scales are figured (Plates 2 and 3) but also considered impractical as key characters.

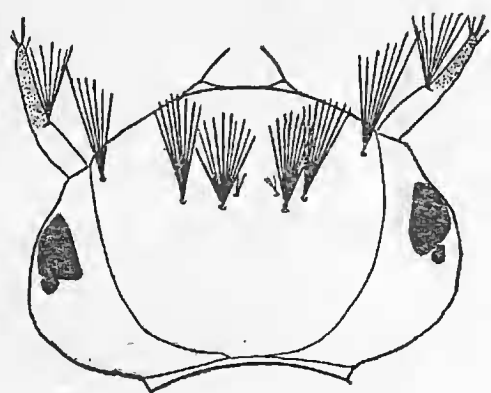
¹From the Bureau of Vector Control, California State Department of Public Health, and the Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Ga.

C. maccrackenae was distinguished from *incidens*, *impatiens*, and *inornata* by the authors cited above, by characters of the anal segment. In *maccrackenae* the anal plate was said to have a cleft within which the anterior tufts of the ventral brush were inserted. In the other species, the cleft has been listed as lacking, the tufts puncturing the sclerotization of the anal plate. In a study of 480 larvae of the four species, including reared correlated series of all but *impatiens* (only one larval skin of a reared *impatiens* was available), variations were so evident in the size of the cleft and in the number and position of the tufts inserted within the cleft, that we have concluded that this character is much too variable for reliable diagnostic purposes. The percentages of variations found in this study are as follows: Of the *incidens* larvae, 33% had no cleft (considered by previous authors to be typical); 33% had one tuft within a small cleft; 18% with 2—3 tufts within the cleft; and 16% had all the tufts within a total cleft. Variations in *maccrackenae* also were pronounced, with 10% without a cleft; 20% with one tuft inserted within a small cleft; 50% with 2—3 tufts within the cleft; and 20% with all tufts within a total cleft (previously considered to be typical). Similar variations were found to exist in *inornata*.

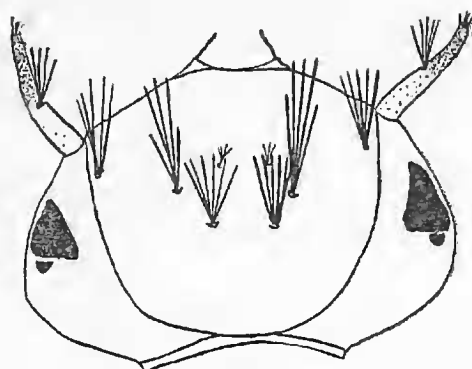
To supplement these previously used characters for distinguishing the larvae of the four species, the following group of new characters are presented:

1. Variations in the branching and the length of the lateral hair of the anal segment.—These variations were found to be reliable in separating *inornata* from the other species (Plate 2). Boddy (1948) found this hair in *inornata* to be double and quite heavy, whereas in *incidens* it was occasionally triple, shorter, and was noticeably less robust. It is described by Carpenter, Middlekauff, and Chamberlain (1946, p. 111) for *inornata* as “. . . long, double or triple,” but it may be 1—5 branched, is usually double, minutely barbed, and as long as or longer than the anal plate (Table I). In the other 3 Californian species the hair may be 1—5 branched, is usually triple, fine, not barbed, and $\frac{1}{4}$ — $\frac{3}{4}$ as long as the anal plate (Plates 2 and 3).

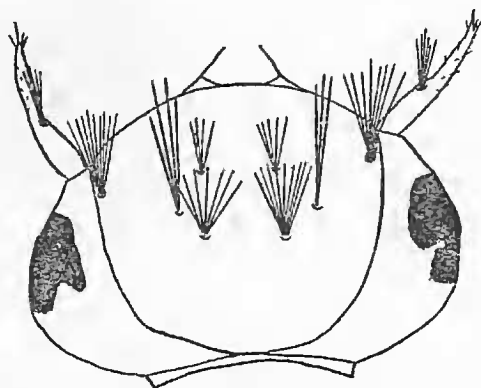
Plate 1.—Diagrammatic sketches of the head and thorax showing the dorsal hairs of diagnostic value of: Fig. A—*Culiseta impatiens*; Fig. B—*C. inornata*; Fig. C—*C. maccrackenae*; Fig. D—*C. impatiens*; Fig. E—*C. inornata*; Fig. F—*C. maccrackenae*; Fig. G—*C. incidens*.



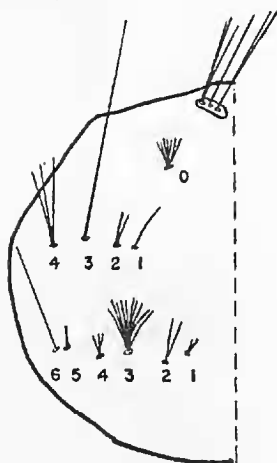
A IMPATIENS



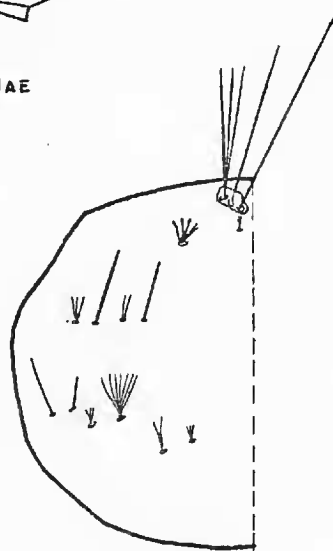
B INORNATA



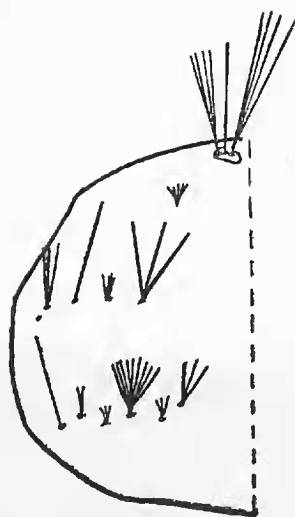
C MACCRACKENAE



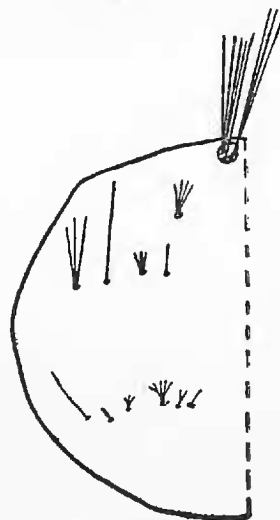
D IMPATIENS



E INORNATA



F MACCRACKENAE



G INCIDENS

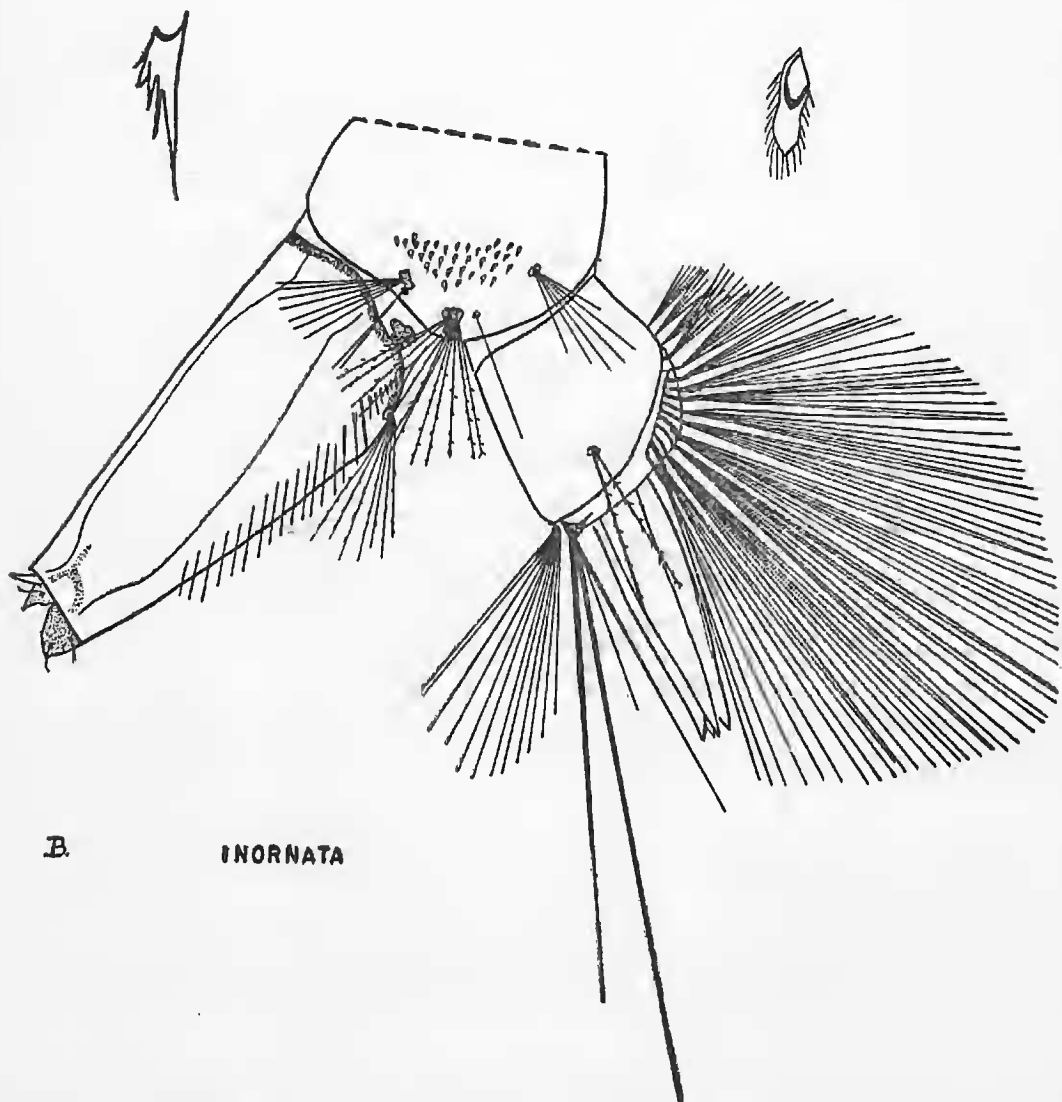
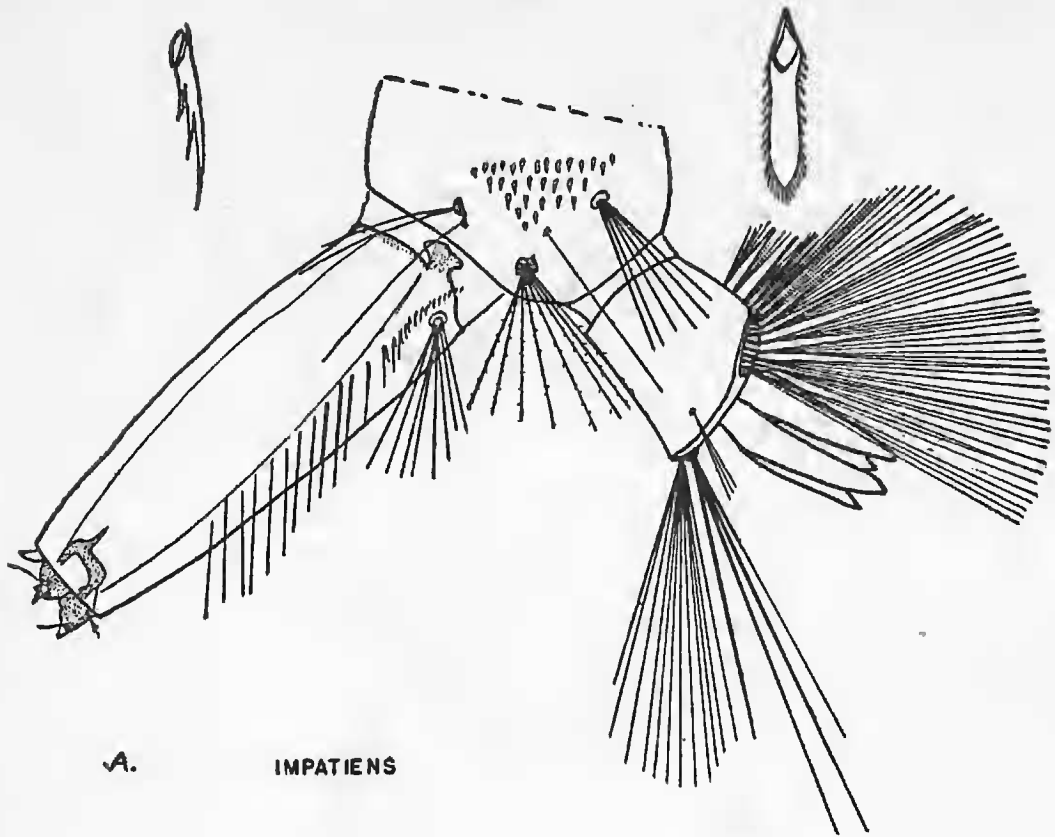


Plate 2.—Lateral view of eighth abdominal segment, siphon, and anal segment (comb scale and pecten tooth enlarged) of: Fig. A—*Culiseta impatiens*; Fig. B—*C. inornata*.

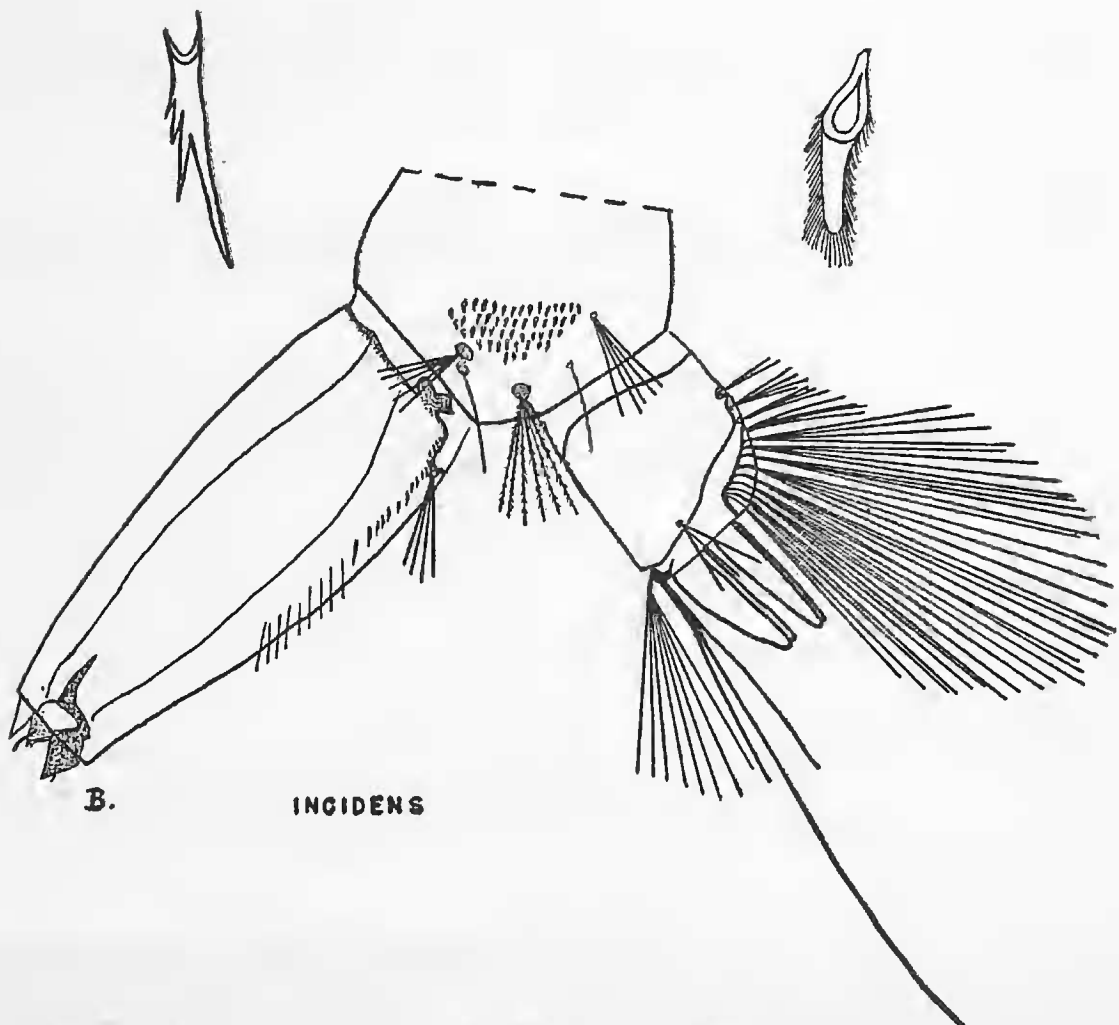
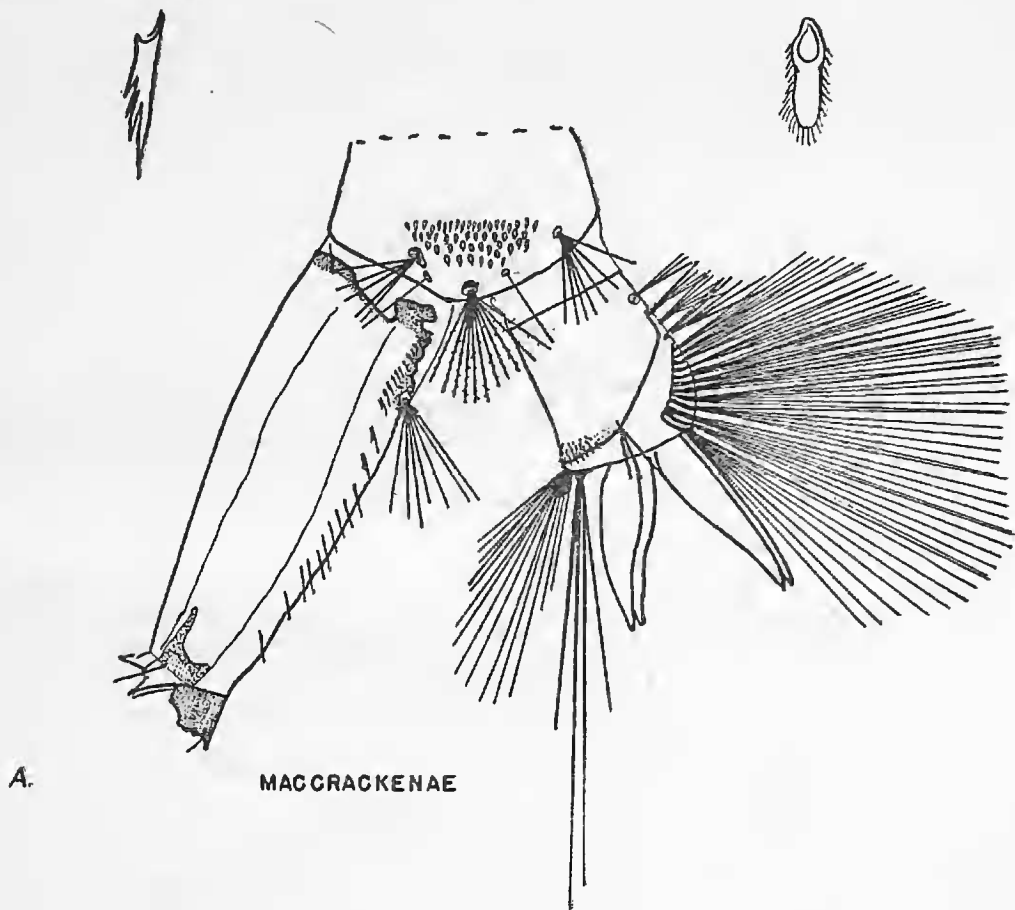


Plate 3.—Lateral view of eighth abdominal segment, siphon, and anal segment (comb scale and pecten tooth enlarged) of: Fig. A—*Culiseta maccrackenae*; Fig. B—*C. incidens*.

Plates 2 and 3 were drawn with the aid of a micro-projector.

2. An area of heavy short spines on the apex of the anal plate near the dorsal brush.—This spiny area is present in both third and fourth instars of *maccrackenae* while the anal plates of *incidens*, *impatiens*, and *inornata* are smooth.

3. The position of the basal siphonal tuft (as suggested by Dr. R. M. Bohart, through personal communication) and the texture, length, number, and position of the normal and hairlike pecten teeth.—The basal hair tuft in all four species is stellate, the branches being arranged much as the ribs in a partially opened umbrella, rather than spread fanlike in the same plane (Marshall, 1938, p. 207). In *maccrackenae*, the tuft is situated in a darkened area in the sclerotization, near the apical normal pecten teeth, which occurs at the apex of a scalloped cleft in the siphon. Following one or two widely-spaced, modified, normal teeth, the hairlike pecten teeth are short, less than $\frac{1}{2}$ as long as the basal tuft, with one or two teeth apically detached; the row of teeth extends from the base along $\frac{4}{5}$ the length of the siphon. In the other 3 species the tuft of the siphon is placed near the base of the pecten. The hairlike pecten teeth in *incidens* are fine, about $\frac{1}{2}$ as long as the tuft, and extend beyond the middle of the siphon. In *impatiens*, the normal

Table 1. Percentages of Variations of the Lateral Hair on the Anal Plate of *Culiseta inornata* (Will.), *Culiseta incidens* (Thom.), and *Culiseta maccrackenae* D. & K.

Species	No. Tufts Studied	Distribution of Percentages of Branch Variations				
		Single	Double	Triple	Four-Branched	Five-Branched
<i>C. inornata</i>	112	6	59	29	3	3
<i>C. incidens</i>	522	4	27	42	21	6
<i>C. maccrackenae</i>	56	4	37	46	11	1

Table 1 (continued):

Species	Distribution of Percentages of Physical Characters					
	Texture			Length		
	Fine and Smooth	Slightly Barbed	Heavy and Barbed	$\frac{1}{4}$ - $\frac{1}{2}$ as long as Plate	$\frac{2}{3}$ - $\frac{3}{4}$ as long as Plate	As long as or longer than Plate
<i>C. inornata</i>	3	14	83	0	18	82
<i>C. incidens</i>	98	2	0	65	35	0
<i>C. maccrackenae</i>	98	2	0	46	54	0

pecten teeth extend from the base $\frac{1}{4}$ the length of the siphon. The hairlike pecten teeth are heavy, $\frac{2}{3}$ as long as the basal tuft. The entire pecten extends $\frac{2}{3}$ the length of the siphon. In *inornata*, these teeth are fine, $\frac{1}{2}$ as long as the tuft, and the row reaches $\frac{3}{4}$ the length of the siphon.

4. The dorsal thoracic hairs.—These are illustrated in Plate 1, Figures D, E, F, and G, where the chaetotaxy followed is that employed by Marshall (1938, p. 47). Only those hairs used in differentiation have been figured. Prothoracic hair No. 1 (Plate 1, Figures E and G) in *inornata* (as pointed out by Dr. H. D. Pratt, personal communication) is single, and $1\frac{1}{2}$ times as long as prothoracic hair No. 2; in *incidens*, this hair is either double or multiple, and slightly longer than hair No. 2; in *maccrackenae* and *impatiens*, this hair is similar in size and number of branches to that of *incidens*, with *maccrackenae* having from 2—8 branches and *impatiens* 1—3. The mesothoracic group of setae is diagnostic in *maccrackenae* and *impatiens* in that hairs Nos. 1 and 3 in *maccrackenae* are respectively, double to quadruple, and single; both prominent and heavy; in *impatiens*, No. 1 is single and inconspicuous, while No. 3 is single, and 6—8 times as long as the prothoracic hair No. 0 (Plate 1, Figures D and F). In both *inornata* and *incidens*, mesothoracic hair No. 1 is single and inconspicuous (Plate 1, Figures E and G).

5. The size of the postclypeal hairs (Plate 1, Figure C).—In *maccrackenae* these are prominent with 4—5 branches, and are almost as long as, and as heavy as, the upper head hairs. This is in contrast to the normal, small postclypeal hairs possessed by the other three species.

The following key to the *Culiseta* larvae of California has been prepared using the foregoing characters.

KEY TO FOURTH INSTAR LARVAE
OF CALIFORNIAN SPECIES OF CULISETA

1. Mesothoracic hair No. 1 large, double to quadruple, and very conspicuous (Plate 1, F); postclypeal hairs 4—5 branched, prominent, about as heavy as those of the upper and lower head hairs (Plate 1, C); posterior margin of anal plate with heavy short spines at apex near dorsal brush (Plate 3, A).....
.....*maccrackenae* Dyar & Knab, 1906
- Mesothoracic hair No. 1 small, less conspicuous, usually single; postclypeal hairs normal with branches noticeably more delicate than branches of the upper and lower head hairs; anal plate smooth2

2. Both upper and lower head hairs multiple, fan-shaped, with branches equal or subequal in number and length (Plate 1, A); mesothoracic hair No. 3 single, conspicuous, 6—8 times the length of prothoracic hair No. 0 (Plate 1, D)
*impatiens* (Walker, 1848)
- Lower head hairs multiple, with two or three prominent middle branches; upper head hairs multiple, fan-shaped, with shorter and more branches than lower head hairs; mesothoracic hair No. 3, if single, inconspicuous, less than 6 times the length of prothoracic hair No. 0.....3
3. Lateral hair on the anal segment as long as or longer than anal segment, rather stout and usually double (Plate 2, B); prothoracic hair No. 1 usually single (Plate 1, E)
*inornata* (Williston, 1893)
- Lateral hair on the anal segment shorter than the segment, rather fine, and usually triple (Plate 3, B); prothoracic hair No. 1 double or multiple (Plate 1, G)*incidens* (Thomson, 1868)

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REFERENCES CITED

- BODDY, D. W.
 1948. An annotated list of the Culicidae of Washington. Pan-Pac. Ent., 24(2):85-94.
- CARPENTER, S. J., W. W. MIDDLEKAUFF and R. W. CHAMBERLAIN
 1946. The Mosquitoes of the Southern United States East of Oklahoma and Texas. Univ. Press, Notre Dame, Ind., 292 pp.
- DYAR, H. G.
 1928. The Mosquitoes of the Americas. Carnegie Inst. Wash. Pub. No. 387, 61 pp.

FREEBORN, S. B.

1926. The mosquitoes of California. Univ. of Calif. Publ. Entomology, 3 (5) :333-460.

FREEBORN, S. B. and B. BROOKMAN.

1943. Identification Guide to the Mosquitoes of the Pacific Coast States. U. S. Public Health Service, Malaria Control in War Areas, Atlanta, Ga., 23 pp.

MARSHALL, J. F.

1938. The British Mosquitoes. Br. Mus. Nat. Hist., London, 341 pp.

MATHESON, R.

1944. Handbook of the Mosquitoes of North America. Comstock Publ. Co., Ithaca, N. Y., 314 pp.

REEVES, W. C.

1941. The identification of California mosquitoes. Proc. Calif. Mosq. Cont. Assn., Appendix I, 13pp.

USINGER, R. L., I. LA RIVERS, H. P. CHANDLER and W. W. WIRTH

1948. Biology of Aquatic and Littoral Insects. Univ. of Calif. Syllabus SS, 244 pp.

A SECONDARY HOMONYM IN THYSANOPTERA

(Thysanoptera: Phlaeothripidae)

Jones (1912)¹ described *Anthothrips flavipes* from a unique female collected at San Jose, California. Since that time the species has had a somewhat stormy taxonomic career, having been relegated in the literature to at least four additional genera. Hood (1949)² transferred this species to the genus *Watsoniella*, apparently overlooking the fact that Moulton (1928)³ employed the name *Watsoniella flavipes* for a new species taken in Abyssinia.

It is unfortunate that Jones' name, which has appeared frequently in the literature, must be changed because of the coexisting Moulton name preceding it in the genus *Watsoniella* by twenty-one years. I therefore propose the name *Watsoniella jonesiana* nom. nov. pro *Watsoniella flavipes* (Jones), nec Moulton.

—H. EDWIN COTT, *Davis, Calif.*

¹U. S. Dept. Agr., Bur. Ent., Tech. Ser., No. 23, Pt. I, pp. 18-19, Pl. V, figs. 5-7.

²Rev. de Ent., 20 (1-3) :23-26.

³Ann. Mag. Nat. Hist., Ser. 10, 22 :241-242.